

Two Proposals for Closing Issue Paper 13: Transmission Rates for On-Ground Aircraft

242A-WP-9-05

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1.0 Background

Issue Paper 13 was generated from comments on the 1090MHz ADS-B MOPS (DO-260) by Rick Cassell and Carl Evers from Rannoch Corporation. The issue paper requests that ADS-B require a constant rate of transmissions for all aircraft while on the ground. DO-260 has implemented a lower transmission rate for aircraft that are deemed to be stationary. (See section 2 of this paper.)

Rick and Carl were asked by WG6 to propose specific MASPS text changes to accommodate their proposal. (Action Item 7-9) They have provided their proposed changes to DO-242 as documented in section 4 of this paper.

At their recent meeting, Working Group 3, authors of DO-260, were informed of Rannoch's proposed MASPS changes and were very concerned. WG3 felt there were some shortcomings with Rannoch's working paper 242A-WP-7-09 and the proposed MASPS changes. These concerns were documented by Bill Harman and are found in Section 5 of this paper.

WG3 believes the MASPS should not be changed in regards to IP13. They have a proposed change to DO-260 that would tighten the requirement on remaining at the "low" transmission rate. This proposal is discussed in Section 6.

2.0 DO-260 Text

2.2.3.3.2.3 ADS-B Surface Position Message Broadcast Rate

- a. Once started, ADS-B Surface Position Messages shall be broadcast by the transmission device when in the On-Ground state using either the "High" or "Low" rate which has been selected as follows:

(1). Switching from "High" rate to "Low" Rate:

- (a). The broadcast rate shall be changed from "High" to "Low" when the navigation **source position data has not changed more than 10 meters in a 30 second sampling interval.**

Note: *It is acceptable to compute the 10 meter distance using either rectangular or polar coordinates.*

- (b). Upon selecting the "Low" rate, the transmission device shall save the Position data at the time that the "Low" rate was selected.

(2). Switching from “Low” rate to “High” Rate:

The broadcast rate shall be changed from “Low” to “High” when the position of the transmission device has changed by 10 meters or more since the “Low” rate was selected.

Note: *It is acceptable to compute the 10 meter distance using either rectangular or polar coordinates.*

- b. If the “High” rate is selected, then the Surface Position Message shall be transmitted at random intervals that are uniformly distributed over the range of 0.4 to 0.6 seconds relative to the previous Surface Position Message.
- c. If the “Low” rate is selected, then the Surface Position Messages shall be transmitted at random intervals that are uniformly distributed over the range of 4.8 to 5.2 seconds relative to the previous Surface Position Message.

Note: *Pending further study and analysis of surface broadcast rates and their triggering mechanisms by regulatory authorities, it is widely assumed that the “Low” rate will be raised to a nominal rate approaching once per second.*

- d. In the event that the transmission device cannot determine the required transmission rate, then the “High” rate shall be used as the default transmission rate.
- e. Exceptions to these transmission rate requirements are defined in subparagraph 2.2.3.3.2.9.

3.0 WG3’s original response to issues raised in IP13

The following was placed in the “Comment/Rational” Column of the original comments made on the 1090 MOPS document:

WG3 feels that changing the 10m criteria for detecting movement to 3m would be a better solution than changing the low-rate from 5 seconds to 1 second. With most airports that would have runway incursion systems also having LAAS, the 3m precision should be attainable. This would prevent changes to DO-181 also, and therefore be a cleaner solution. If this solution is acceptable, there is not an issue here for DO-242A.

4.0 Rannoch’s suggested resolution for IP13 (AI 7-9):

Following is the recommended change to the MASPS. A corresponding change will eventually have to be made to the MOPS to remove the variable update period on the surface.

Table 3-4, under "Airport Surface" column/"Nominal Update Period" row change to

" ≤ 1.5 s (note 14)"

Table 3-4, under "Airport Surface" column/"99th Percentile State Vector Report Received" row change to

" ≤ 3 s ([note 14](#))"

Add the following note:

14. Requirement applies to both moving and stationary aircraft and vehicles.

Rationale - Clarification that a longer update interval for a stationary aircraft or vehicle is not allowed.

5.0 Response to 242A-WP-7-13 and proposed IP13 resolution from Bill Harman, MIT Lincoln Laboratory and WG3 member

During the October 17-18 WG-3 meeting, we discussed the proposal made by Rannoch Corp. for a MASPS change relating to surveillance on the airport surface. This topic is of serious concern to those of us working on Extended Squitter. The proposed MASPS change is stated briefly in 242A-WP-7-13 (August 21, 2001). Working Group 3 would like to offer the following comments on this subject.

1. The Rannoch paper is very brief. It has some inaccuracies, which may be due to misunderstands or just the condensation into such a short paper. We would like to discuss this directly with the authors, Carl Evers and Rick Cassell. In the meantime, we have a few comments on the paper as is.
2. The existing design was largely based on the realization that sometimes, rarely, there are VERY many aircraft on the airport surface in the movement area, which are essentially parked and waiting because of bad weather at other airports. When this happens, most of them are stationary for long periods of time.
3. The existing design was developed to avoid excessive interference while providing effective surveillance for both moving and stationary aircraft.
4. The existing design has been coordinated internationally. Some European members of ICAO are very concerned about interference conditions, and would likely object to an increase in interference. After a long period of international coordination, the existing design is now standardized in SARPS.
5. The Rannoch paper begins with an "ideal" in which a position is always transmitted within one second of the time the nose of an aircraft crosses a hold line. However the proposed MASPS change would require high-rate transmissions during parking in the movement area. It is therefore appropriate to consider whether the performance of the existing design would be unsatisfactory. Criticizing the existing design, the authors cite their "experience with implementing runway incursion avionics," and they say they believe that it is

critical to maintain positive/periodic surveillance, but the specifics are not made clear. One paragraph refers to testing at Dallas-Fort Worth, but it does not provide specifics that relate the Extended Squitter design to any performance degradation.

The preceding paragraph says that an initially stopped aircraft can travel a significant distance in 10 or more seconds. This suggests that the authors are not familiar with the specifics of the existing design (which is based on a change in position in a 10 second period). The final paragraph criticizes a design that would use aircraft speed for switchover. This too suggests that the authors are not familiar with the specifics of the existing design. It is not based on speed, but is based on a change in position during a 10 second period.

6.0 Working Group 3's proposed course of action.

There is strong feeling within WG3 and the entire 1090MHz community that a higher transmission rate for all aircraft on the airport surface will cause a great deal of interference in the 1090MHz bandwidth. WG3 urges that IP13 not be implemented in DO-242A. Further, it is WG3's position that they will not be able to comply with the proposed changes, and they will therefore not be implemented in Mode S-based ADS-B systems. If this occurs, it will not help any of the runway incursion and surface monitoring applications for which IP13 was written to support.

WG3 has proposed tightening their DO-260 requirement for determining when an aircraft has moved from 10 meters to a lower value yet to be determined. The 10 meter requirement was derived as the minimum value possible that would not trigger too many false movement detections based on the quality of position data. This was done while GPS still had SA on. With SA now turned off, WG3 believes they will be able to lower the 10 meter value towards the 3-5 meter range. Analysis will be done, and coordination with ICAO will be needed to ensure the SARPS will also change.